WILDLIFE REVIEW

AN ABSTRACTING SERVICE FOR WILDLIFE MANAGEMENT
ISSUED FOR THE INFORMATION OF COOPERATORS
BY THE
BUREAU OF BIOLOGICAL SURVEY
UNITED STATES DEPARTMENT OF THE INTERIOR

All of the abstracts in this issue of WILDLIFE REVIEW are of papers appearing in the

Transactions of
the Fourth North American Wildlife Conference
held in Detroit, Mich.,
February 13-15, 1939.

CONTENTS

	Page
Abstracts:	
Conservation: General	2
Cycles: Grouse, Ruffed	2
Destruction: Habitat by hurricane	3
Diseases and parasites	3
Ecology:	
Census methods	4
Census methods, pheasant	4
Drainage operations	5
Land-use in relation to pheasant production	5
Mosquito control operations	6
Nesting success	7
Openings	8
Overpopulations	8
Education: Conservation	9
Food habits	10
Life histories:	
Bighorn	11
Deer, Mule	12
Deer, White-tailed	12
Dove, Mourning	13
Ducks	13
Grouse, Sharp-tailed	13
Muskrat	14
Prairie chicken	14
Shoveller	14
Woodcock	15
Abstracts--Continued	
Management:	
Clearing	15
Farmer-sportsman relationship	15
General	19
Harvesting antelopes, Oregon	20
Harvesting deer, Wisconsin	20
Herd regulation	20
Inventory, cottontail	21
Inventory, deer	22
Planting aquatics	22
Planting for wildlife and erosion control	22
Pond development	23
Quail, Valley	24
Refuges	24
Stocking ducks	25
Stocking, partridge, chukar	25
Stocking, trapping pheasants	26
Swan, Trumpeter	26
Natural history: Indication of age	27
Propagation: Irradiation results	27
Research	27
Special articles	29
Author index for this issue	35

Washington, D. C. No. 23 October, 1939

The Transactions of the Fourth North American Wildlife Conference, a paper-bound volume of ix+644 pages, published in September 1939, may be obtained from the American Wildlife Institute, Investment Building, Washington, D. C., for $1.00 a copy, postpaid.

Conservation: General

Lloyd, Hoyes, and Ira N. Gabrielson. A continental review of the wildlife resource, pp. 75-86.

Lloyd. To protect fur animals in Canada, reserves are established where only natives may trap. The total area of these reservations is 584,000 square miles. Under protection, musk oxen are beginning to increase. The introduced reindeer are thriving and their presence will relieve pressure upon caribous. Restoration by a number of agencies of water areas beneficial to wild fowl and fur bearers is in progress, and bird sanctuaries are being added. Hand-rearing of waterfowl to supplement the wild supply is being attempted. The eider-down industry gives people a personal interest in conservation of eider ducks that is more effective than police protection. In general, 1938 saw increase in the number of waterfowl over the greater part of Canada.

Gabrielson. Comment on increased interest in wildlife, in personnel trained in wildlife management, and in the volume of research. States are showing an increased tendency to apply the results of technical investigations. Management is being more widely adopted. Waterfowl are increasing and the Federal refuges are contributing greatly to protection of the birds. Their importance in producing wild fowl also is rapidly growing. The cooperation of State representatives working out a constructive program of wild fowl restoration is acknowledged. The number of hunters is growing rapidly, hence restrictions on the kill are, and will continue to be, necessary. Federal wildlife refuges of all types under administration by the Biological Survey number about 250, embracing some 13,500,000 acres. Recent additions have been for the benefit of the great white heron, the white-crowned pigeon, and the desert bighorn. Lands transferred from the acquisitions of the Rural Resettlement Administration are enabling the Survey to protect additional forms of wildlife. The Agricultural Adjustment Administration has for the first time included among reimbursable practices, specific provisions for the benefit of wildlife. The Federal aid to the States program of wildlife restoration got rapidly under way and is very promising.

Cycles: Grouse, Ruffed

Bump, Gardiner. Some characteristics of the periodic fluctuations in abundance of ruffed grouse, pp. 478-484, 2 figs., 1 table.

Analysis of 1,500 records of grouse abundance gathered by the New York State Ruffed Grouse Investigation. Prevailing information and impressions respecting cycles are sketched. There is proof of a period of scarcity following abundance more than 100 years ago. The evidence for periodicity in numbers is discussed and charted; it is not entirely unequivocal but may, perhaps, be regarded as indicating cycles modified by type of cover, regional lag, and

other factors. Behavior of the grouse population of the Connecticut Hill area near Ithaca during 3 phases of the cycle is briefly noted. The primary cycle is often obscured by local fluctuations of independent causation.

Destruction: Habitat by hurricane

Griffith, Richard E. Effect of the 1938 hurricane on waterfowl areas on the North Atlantic Coast, pp. 406-410.

Characteristics of the storm and of the tidal wave it engendered. This covered some marshes by washing sand over them, the receding waters scoured shallow flats carrying off large quantities of duck foods, and the cutting of new, and enlarging of old, inlets increased the salinity of waters along the south shore of Long Island. Freer flow of the tide may compensate in part for the drainage effects of ditches in the salt marshes. The sand deposits obliterated many beds of waterfowl food plants but doubtless enough seed stock remains to replace them in a few years. The scouring action was beneficial in removing sludge inimical to the production of wild duck foods and harmful in depleting the existing supply. Bad effects of increased salinity probably will be temporary. There was wholesale destruction of trees and shrubs along much shore line and even far inland. Suggestions are made as to what management may do to repair the damage wrought by the 1938 storm and to minimize that from possible future hurricanes.

Diseases and Parasites: Botulism

Coburn, Don R., and E. R. Quortrup. Recent findings in relation to the control of botulism in waterfowl, pp. 359-363.

Under optimum conditions either flooding or draining can achieve control. Conditions often are not perfect, however, and reliance must not be placed on methods heretofore considered generally valuable. Unqualified persons have suggested remedies that have seriously objectionable features.

Authors' summary: "With knowledge that the decomposition products of numerous kinds of marsh vegetation inhibit the growth of Clostridium botulinum and neutralize preformed toxins, new and valuable weapons are placed in the hands of those concerned with the management of wildfowl areas. Suggestions for management include, in addition to flooding and draining already in vogue, the use of vegetation for the production of beneficial decomposition products, for windbreaks, for repellents to discourage the use of danger areas, and for food patches to attract birds to safe waters. A wide variety of emergent, surface, and submerged plants are available for these purposes. Indirect control of water as affected by wind action may be maintained by plantings, making artificial islands, and by providing deep canals for water return. Direct control through a system of dikes and canals is recommended where other methods do not avail. Properly built and located artificial islands will serve as resting grounds attracting waterfowl away from dangerous shallows and mud flats. Algal growths of the Cladophora group are potentially dangerous as producers of culture media and anaerobic conditions. The known role of animal flesh remains,

as favorable incubators of botulinus organisms, makes safe disposal of this material necessary. Until further trials of disinfectants are made under field conditions their use cannot be recommended."

Diseases and Parasites: Deer, White-tailed

Whitlock, S. C. The prevalence of disease and parasites in whitetail deer, pp. 244-249.

Review of the subject (giving 8 bibliographical citations) with special reference to the deer of Michigan. Running comment upon numerous parasites including notes on their occurrence, abundance, and importance. The white-tailed deer, given a satisfactory food supply, appears to be well-equipped physically to resist the various maladies to which they are susceptible. Winter food is a more serious limiting factor but something can be done about that. The species thus appears to be quite amenable to management.

Ecology: Census methods

Ruff, Frederick J. Region 8 technique of wildlife inventory, pp. 542-545.

Game drives are expensive (22 cents per acre) and impracticable in rugged country. Strip censusing is far more economical, can be applied almost anywhere, and gives satisfactory results. Counting deer or their tracks along roads from automobiles are convenient supplementary methods that soon yield more data than pedestrian tactics. These plans and modifications to improve them are being tested. The success achieved in regulated hunting, live-trapping, and fawn-catching also is indicative of population numbers, and figures representing it can be used to compute absolute numbers when applied to suitable estimates of relative abundance. Reliable periodic estimates permit satisfactory formulation of management plans.

Ecology: Census methods, pheasant

Randall, Pierce E., and Logan J. Bennett. Censusing ringneck pheasants in Pennsylvania, pp. 431-436, 7 tables.

Application of the method developed in Iowa by Bennett and Hendrickson to Pennsylvania. Occurrence and pertinent habits of the birds are described and counts in different areas tabulated.

Authors' summary: "(1) The Iowa pheasant census technique is applicable to areas studied in southeastern Pennsylvania and seems to have possibilities for large-scale application in pheasant ranges; (2) the cost of such a census is very low, and the method appears to be much more accurate than any other method yet devised for large areas; (3) roadside counts should be made from an automobile traveling 15 to 20 miles an hour over gravel or dirt roads; (4) the time to make counts is from sunrise to one and one-half hours later. They should be made on clear fall days having normal dew-fall. Rainy, foggy, cloudy, and dewless mornings are not satisfactory times; (5) six to eight birds a mile

indicated a population of 1 bird to 2 acres. Two to three birds a mile indicated 1 bird to 4 acres. Seven-tenths to 1.82 birds a mile indicated 1 bird to 6 or 7 acres. Twenty-five hundredths to 0.60 bird a mile indicated 1 bird to 18 or 20 acres; (6) the largest ringneck pheasant populations were in those areas that had the largest acreage planted in corn."

Ecology: Drainage operations

Bourn, Warren S., and Clarence Cottam. The effect of lowering water levels on marsh wildlife, pp. 343-350.

Classification of marshes and description of their principal plant associations. Water level is usually the dominant ecological factor and altering it may have far reaching effects on both flora and fauna. Plants may be replaced by others less valuable to wildlife and drainage, lowering the water level only a few inches, may bring about great reduction in invertebrate populations so important as a food resource for vertebrates. Examples are given for 4 plant associations, the reduction by percentage ranging from 43.5 to 92.6.

Ecology: Land-use in relation to pheasant production

Leedy, Daniel L. Some land-use factors related to pheasant production, pp. 525-533, 1 table.

Author's summary: "(1) The various methods used in harvesting corn, soybeans, and small grains in Ohio are discussed in relation to pheasant production; (2) the present trends in harvesting methods are in general beneficial to pheasant production. Surveys in 4 counties indicated that in 1936, 7.9 per cent of the corn was picked, 23.0 per cent in 1937, and 38.0 per cent in 1938, making increased quantities of waste grain available for wildlife; (3) less than 15 per cent of the picked corn in Wood County is pastured--a favorable practice--and 42.1 per cent of the pastured cornfields observed were partially or entirely enclosed by electric fences--an unfavorable one. Less than 20 per cent of the mechanically picked corn was repicked by hand, thus leaving waste grain in most of the fields; (4) the pheasants on one Wood County refuge consumed about 186 bushels of corn obtained in cornfields during a four-month period following the hunting season in 1937; more than 91 per cent of this was waste; (5) wheat is an important source of food of Ohio pheasants and the high stubble left by combines furnishes ideal cover. Wheat stubblefields are utilized twelve times as much as oat stubblefields for pheasant roosting sites; (6) surveys made in thirteen fields of soybeans, combine harvested, indicated that there was an average waste of 3.79 bushels per acre in 1938; (7) smartweed seeds are valuable pheasant food and an average of 48.3 pounds of smartweed seeds were found per acre in four cornfields; (8) ragweeds produced 85.90 pounds of seed per acre in fifteen wheat stubblefields sampled, and 5 pounds per acre in eight oat stubblefields; (9) the methods used in calculating the amount of weed seed produced per acre are described; (10) the practice of clipping small grain stubblefields, as a ragweed control measure, is detrimental to pheasants; (11) approximately one-third of the hen pheasants nesting in meadows are killed or crippled during the mowing season; (12) about 20 per cent of the pheasant nests in the non-crop land of Wood County were found along drainage ditches, which furnish valuable food

and cover and serve as travel lanes; (13) some of the shallower ditches are being replaced by tiles, converting waste land ideal for cover into cultivated land." Bibliography of 9 titles.

Ecology: Mosquito control operations

Williams, Louis L., Walter B. Jones, J. Lyell Clarke, Clarence Cottam, and Warren S. Bourn. Need mosquito control be incompatible with wildlife?, pp. 114-136.

Williams. Only one species of Anopheles (A. quadrimaculatus) is important as a vector of malaria. Its habits are such that it is favored by impoundments of water flooding brushy areas. There food is abundant and enemies few. Dense swamps are unfavorable but partly logged-off swamps are good breeding places. Pioneer land uses created malaria hazards. "In the era of major drainage ending about 20 years ago, the malarious area was reduced about one-half; in the impounded water age, in which we now live, the malarious area is increasing." Most of the Southern States have adopted regulations for malaria mosquito control in impoundments. The top minnow is not so important in controlling anopheline reproduction as widely believed; wave action on clean shore lines is much more useful. Fluctuation of the water level is another and sometimes very successful means of control. Where it cannot be properly employed, treatment with larvicides is necessary. Complete biological control at a reasonable cost is something yet to be devised.

Jones. Drainage destroys habitat without which certain animals cannot live. An even worse effect is lowering of the water table. Oil treatment kills top minnows which, in biologically balanced waters, contribute to an association that controls mosquitos. Fluctuating water levels and applying sodium arsenate destroy vegetation, essential to wild ducks and fishes. Present mosquito control practices are entirely destructive, not at all constructive. Ten recommendations for improvement in the program are: "(1) That the health authorities confine their principal activities to areas of concentrated population; (2) that they provide biological control for sparsely populated areas; (3) that they use preventive medicines to reduce or destroy malaria in man; (4) that they emphasize research in preventive medicines; (5) that the money now wasted on ineffective control be used for the screening of houses in infected areas to reduce the spread of the disease; (6) that drainage be abandoned or minimized and wherever possible impoundment substituted therefor and biological control be provided in all such areas; (7) that deliberate fluctuation of the pool levels in impoundments be abandoned as totally destructive; (8) that suitable food plants be provided for duck and fish life; (9) that all health programs be coordinated with biological and wildlife interests; (10) that around all habitations, all receptacles capable of holding water be destroyed, treated, or covered."

Cottam and Bourn. There can be no opposition to the principle of control but wildlife conservationists seriously object to excessive control and to methods unnecessarily destructive to wildlife or its habitat. Mosquito control can be coordinated with wildlife conservation if done only where needed, kept to a reasonable minimum, carried out under competent supervision according to

plans giving biological factors due weight, characterized by preferential use of the least destructive methods, and balanced by creation of new wildlife habitat to compensate for any necessarily destroyed. Examples of coordinated campaigns are cited from Illinois and Rhode Island. Control of water levels is preferable to drainage; suggestions are given for the treatment of coastal marshes and ponds. Ditching has been excessive and maintenance failing, as seems unavoidable, mosquito hazards are increased. Moreover the campaign appears to have reduced neither the number of cases of malaria nor the death rate in the Southern States. Greater emphasis should be placed on therapeutic control of malaria, some types of which appear to be satisfactory. The message of this contribution is summarized in 8 short paragraphs.

Clarke. In response to public demand, mosquito control operations have changed from those done without thought of environmental values to others that will preserve scenic amenities and balanced ecology, the latter a necessity for control. The habits of mosquitos in 3 seasonal groups are discussed with relation to control measures, among which those not destructive to wildlife or its habitat are favored. Intermittent marshes provided with a deep central pond and radiating ditches will conserve mosquito predators that will spread through the area with rising water levels and consume the mosquito larvae. Biological methods of control are urged and examples cited. Pyrethrum larvicide, harmless to wildlife, is more destructive to mosquito larvae than are the objectionable oils. Mosquitos transmit diseases of wildlife as well as those of humans in number that seems steadily to increase. "If we would protect the natural habitats of wildlife, let us be ready with reasonable and effective mosquito control methods, for the public certainly will not stop to consider wildlife when the ravages of some terrifying disease is upon them."

Ecology: Nesting success

Kalmbach, E. R. Nesting success: Its significance in waterfowl reproduction, pp. 591-604, 5 tables.

Nesting success of numerous species as recorded in the literature, of which 56 titles are cited, discussion of losses by groups of birds, and of the causes, incorporating throughout the writer's field experiences.

Author's summary: "To appraise the significance of egg loss among waterfowl, comparisons have been made with similar losses experienced by (1) upland ground-nesters, (2) species that nest above the ground (largely bush- and tree-nesters), and (3) hole-nesting species. An average nest success of 43 per cent was noted among upland ground-nesters as disclosed in 22 separate studies involving 5,600 nests. The average for bush- and tree-nesters was 52 per cent, a fact revealed by the history of more than 670 nests in eleven studies. The hole-nesters were most successful, with a rating of 73 per cent as determined in twelve studies involving more than a thousand nests. In twenty-two field studies of nesting waterfowl, including the histories of more than 7,600 nests of thirteen species, the average degree of nest success was 60 per cent. Had the results from three studies conducted under adverse nesting conditions been omitted, a success rating of 63 per cent would have been recorded. On the basis of abstract hatch, therefore, waterfowl seem to succeed

better than either upland ground-nesters or bush- and tree-nesters, but fall below the standard of the relatively securely housed hole-nesters. On the assumption that 63 per cent success represents the average among waterfowl nesting under varied conditions, and with the knowledge that, under advantageous conditions, much higher survival has been obtained, it has been concluded that 70 per cent success may be looked upon as satisfactory on managed refuges. That average has already been attained and even exceeded on refuges most advanced in development and management. With that satisfaction also comes the conviction that loss of the complementary 30 per cent is normal, probably inevitable, and apparently inconsequential in the equation that ultimately determines the total supply of ducks.

As for the suppressive factors, they are many and varied. There may be wide divergence in their character and importance on the different refuges and they may show marked diversity on the same refuge from year to year. With numerous elements exerting an influence on the hatch, rational management calls for control of those that investigation has shown to be locally or temporarily most destructive. This policy has particular merit as applied to the handling of predators. It is much to be preferred to the wholesale control of proscribed species everywhere with the expectation that a general benefit will be forthcoming."

Ecology: Openings

Gray, Donald V., and Louis C. Hormel. A study of game cover and openings in the Buck Creek plantations, Huron National Forest, Michigan, pp. 554-559, 1 map., 6 tables.

Due to failure of planted trees, the plantation selected for study had about the same proportion of openings as an adjacent natural woodland. Details are given in a map and the tables. An unplanted area about 71 percent open was included in the survey. It appears that the small game and fur animal populations were not greatly different in the planted and unplanted areas. There were more rabbits and squirrels in an area where slash had been left in piles than where complete disposal had been practiced. The plantation in its present stage seems to provide a pattern of openings which could scarcely be improved upon if deliberately planned.

Ecology: Overpopulations

Cliff, Edward P. Relationship between elk and mule deer in the Blue Mountains of Oregon, pp. 560-569, 2 figs., 2 tables.

Greatly reduced by pioneer utilization, deer and elk under protection increased until there were too many of them for their own good. Capacity of the winter range is the limiting factor and in that range the animals often become competitors for food. A table lists the winter foods and indicates their utilization by mule deer and elk. A graph shows increase in these animals on the Whitman National Forest from 1921 to 1938. The mule deer are unable to compete successfully with elk because of physical disadvantages and under competition are gradually replaced. A great loss of deer occurred in the winter

of 1931-32; since that time the species has made partial recovery but individuals are of lower average weight. The killing of bull elk has not resulted in keeping the herd within bounds. Mule deer are superior as game animals and about three times as many of them as of elk can be maintained on the same amount of forage. Where the objective is to make more sport they should be favored. Whichever animal is favored, the total population should be kept at all times below the sustained carrying capacity of the range.

Education: Conservation

Ross, W. A., C. W. Warburton, E. Laurence Palmer, Tom Wallace, and Frank E. Mullen. Education, a powerful tool for wildlife restoration, pp. 87-112.

Ross. The conservation attitude is a state of mind that can be encouraged by education. Four principles of education are outlined. A very important one is participation and progress in that respect in the conservation field is illustrated by accomplishments in numerous localities of "Future Farmers"--vocational students in high schools, numbering about 200,000. Plans of the U. S. Office of Education for direct participation in the teaching of conservation are outlined. Present vast expenditures for conservation emphasize the neglect of education in this field without which schooling is incomplete.

Warburton. The U. S. Extension Service attempts to coordinate all findings affecting rural people and to focus them on fundamental local problems. The county land planning committees offer a great opportunity to all interested in land utilization. The Extension Service confidently expects that land-use planning will give wildlife conservation an impetus that will accomplish much within the next few years. The future of wildlife rests so largely with landholders that interesting and instructing them is of paramount importance. Various specialists of the Extension Service participate in the work, and some have been employed specifically for it in Texas, Iowa, and Michigan. Activities in Texas are briefed and accomplishments in numerous localities, especially through 4-H Clubs, are summarized.

Palmer. Education has been a great factor in the advance of agriculture and it can play a similar role in conservation. Agriculture has succeeded so well that limiting production is the watchword; perhaps wildlife management can follow this example. Conservation departments do not yet realize the need and value of spending a reasonable proportion of their funds for education but that realization will and must come. A preliminary review is given of conservation education in the United States, survey of which is under way. The importance of practical education is pointed out and the speaker believes it is suitable for schools of all grades, and not only for those of secondary or higher rank. Several approved publications are named. What agriculture has done by its educational techniques, wildlife can do if it doesn't expect too much in a hurry. "Agriculture has learned how to produce a superabundance in part by means of floods of suitable, local, cheap, printed material coupled with agricultural education centering in trained leaders free to serve strategic areas. It has recognized that the imagination and cooperation of youth is essential and that a functional education coupled with research and an adequate

financial program might well do more than all the laws in the world. I might even venture to predict that a land-owner class enlightened in the value of wildlife, protected in its rights and fairly rewarded for its cooperation would solve so many of the problems of wildlife restoration that laws might be unnecessary and there would be an abundance of wildlife for all groups interested in it and willing to assume a just responsibility in it."

Wallace. The best educative influence that can be brought to bear is that of the daily press and the county weeklies. Authentic material prepared in a way that will help sell papers is needed. A scholarship for training outdoor writers proposed.

Mullen. Education of youths not adults is most promising. Conservation textbooks unifying the subject are needed. The press is willing to do a hundred times what it is now doing and radio is ready to serve. Appeal to selfish motives is most productive of results.

Food Habits: Grouse, Ruffed

Darrow, Robert. Seasonal food preferences of adult and of young grouse in New York State, pp. 585-590, 1 fig., 4 tables.

Report based on analyses of the contents of the stomachs of 485 adult and 332 young grouse. Results are given for these age groups and for 3 regions of the State, the Adirondack, the Catskill, and the remainder. The ten most important plant foods (genera) are tabulated and discussed as are also seasonal variations in use of these foods and others of lesser rank. Animal foods, of most importance to the chicks, are more briefly annotated.

Food Habits: Nutritional requirements, deer

Davenport, L. Verne A. Results of deer feeding experiments at Cusino, Michigan, pp. 268-274, 4 figs.

Progress reports on carrying capacity and controlled feeding experiments. In yarding territory where swamp conifers are the predominant browse, the carrying capacity during years of maximum production is 2-3 deer per acre and in upland hardwoods probably well below one deer per acre. In the controlled feeding tests a considerable variety of foods were given singly or in combinations. The trials were in winter, and with the exception of fawns in 2 experiments, the animals invariably lost weight. The lowest loss when natural foods were used was with a combination of 6 kinds of browse--white cedar, hemlock, hard maple, white birch, black ash, and basswood. Stock feeds and browse supplemented by such feeds in most experiments maintained weights better than the natural foods.

Food Habits: Snakes

Uhler, F. M., C. Cottam, and T. E. Clarke. Food of snakes of the George Washington National Forest, Virginia, pp. 605-622, 5 tables.

Brief description of the Forest and of game conditions there. About 900 snakes were collected of which 418 contained sufficient food to warrant tabulation. These represented 15 species, the general, and food, habits of each of which are discussed; for 11 species the findings are tabulated. A very considerable addition to the undesirably low stock of definite information on the food of snakes.

Food Habits: Squirrel, Fox

Baumgartner, Luther L. Foods of the fox squirrel in Ohio, pp. 579-584, 5 tables.

Report upon more than a thousand hours of food habit observations and upon analyses of 78 stomach contents. Those of 63 stomachs averaged 25.2 grams in weight. Vegetable foods are tabulated in the order of their importance, each of the following being given the highest rating: acorns, nuts of hickory and beech, and seeds and buds of maple and elm. The animal food (of little importance) also is tabulated. Foods are classed and discussed as staple, emergency, and auxiliary and listed according to their occurrence in the major fox squirrel habitats. Utilization of mineral salts and water and characteristics of feeding habits are discussed. Bibliography of 7 titles.

Food Habits: Turkey

Martin, A. C., Franklin H. May, and Talbott E. Clarke. Early winter food preferences of the wild turkey on the George Washington National Forest, pp. 570-578, 5 tables.

Report based on field observations and 114 stomach analyses. In bulk, grapes, acorns, corn, and fruits of dogwood are the leading items, 93 percent of the food being vegetable. Consumption of the different foods is discussed in the light of their natural availability. A comparison of the plant foods of the turkey and the ruffed grouse from the same area is made in table and text. The turkey is favored by a larger proportion of openings than is required by the grouse.

[Bibliographers note that a slip in marking copy for the printer resulted in transposition of the names of the authors; May is the senior author.]

Life Histories: Bighorn

Allen, Joseph C. Ecology and management of Nelson's bighorn on the Nevada mountain ranges, pp. 253-256.

This subspecies has been reduced by pot and trophy hunting to pitifully small remnants. Natural enemies especially eagles require control if this sheep is to be increased in numbers, but poaching is the greatest obstacle and must be stopped. Information on the life history of the bighorn included in the article relates to its range preferences, daily and seasonal movements, food habits, mating, and lambing. Development of water supplies and other management procedures are suggested.

Life Histories: Deer, Mule

Rasmusson, D. I. Mule deer range and population studies in Utah, pp. 236-243, 1 fig., 5 tables.

Studies were made chiefly in the Logan Canyon area of the Cache National Forest, which is mapped and briefly described. Estimates by the Forest Service show rapid increase in the deer herd despite open seasons on bucks. Winter censuses on the study area revealed about 3,000 animals in 1938-39; the sex ratio was 1 buck to 3.17 does in 1937-38, and 1:3.59 in 1938-39. Winter range is insufficient and considerable feeding has been done. It does not completely check winter losses attributed to malnutrition nor does it prevent over-utilization of browse. There is no evident conflict in use between deer and livestock on either area as the winter range is not grazed by domestic stock and the summer range at present provides abundant feed for both classes of animals. The summer population, according to sample counts, is about 17.2, and the winter numbers from 200-300, deer per square mile. Results as to removal of deer by hunting in 1936-38 are given in a table that records also age classes and average weights of the animals. Tagging studies revealed that there is very little migration of deer on or off the area and, therefore, that the Logan Canyon deer population constitutes a fairly distinct herd. There is a summary and bibliography of 4 titles.

Life Histories: Deer, White-tailed

Chapman, Floyd B. The whitetail deer and its management in southeastern Ohio, pp. 257-267, 2 figs., 1 table.

History of the deer population of the State, and summary of a recent study (1935-38). The form involved is the southern white-tail (Odocoileus v. virginianus), notes on the present numbers and distribution of which are given. From author's abstract: The purpose of the investigation was to obtain basic data for a deer management program in Ohio, in order to forestall the development of a "deer problem" such as that existing in neighboring States. Deer now occur in 30 Ohio counties, with the greatest concentrations along the Pennsylvania border and in the Scioto-Adams County area of southern Ohio. Pertinent facts in the life history, including sex ratios, adult-fawn ratios, time of antler fall, mating period, fawning period, number of fawns per doe, and other statistics are presented. Causes of mortality (poaching, dogs, and accidents) are discussed. Malnutrition is apparent after severe winters, but as yet there have been no losses due to starvation. Seasonal food and cover preferences are recorded in tables. Water and salt requirements were investigated, and it was found that drinking water is not necessary for deer in southern Ohio. Salt licks and salt blocks were utilized only by does, and by them only in the summer months. The white-tail deer has an important place in the wildlife land use program projected for southeastern Ohio, and the educational, esthetic, and economic possibilities of the species are stressed. The paper is concluded with a list of management recommendations and a bibliography of 9 titles.

Life Histories: Dove, Mourning

Pearson, Allen M., and George C. Moore. Nesting habits of the mourning dove in Alabama, pp. 468-473, 1 fig., 2 tables.

Authors' summary: "Data are presented for 592 mourning dove nests in Alabama. Nests were built in numerous species of trees, but more in pines than in all other kinds combined. The nesting sites ranged in height from on the ground to 65.9 feet, with a mean of 21.72 feet and a modal interval of 11 to 15 feet. A typical nesting period of 33 days covered nest-building, 7 days; incubation, 14; and the nestling period, 12. The nesting season lasted from late in February until mid-October. A total of 47.8 per cent of the functional nests under observation were destroyed by predators, winds, or other agencies. x x x Management to improve nesting conditions for the mourning dove in Alabama appears impracticable. There is at present no shortage of suitable nesting sites. An innate characteristic of mourning doves that causes them to use nests of flimsy construction evidently cannot be changed. It may be that nest predators should be reduced in some localities, but further study is needed. The most important dove-management problem at present in relation to nesting is proper adjustment of the hunting season to the nesting period. Adequate nesting data are now available for use in placing the mourning dove hunting regulations of Alabama on a sound basis."

Life Histories: Ducks

Hochbaum, Albert. Waterfowl studies at Delta, Manitoba, 1938, pp. 389-394, 4 tables.

First season's results of an ecological study of waterfowl on a marsh adjoining Lake Manitoba. Reports are made on sex ratios by species (average for river ducks 41:59, for diving ducks 52:48), age ratios (adults to juveniles: lesser scaup 26:74, blue-winged teal 28:72), composition of shooting kill (mallard 30%, lesser scaup 26; canvasback 16), and behavior during the flightless period.

Life Histories: Grouse, Sharp-tailed

Baumgartner, F. M. Studies of the distribution and habits of the sharptail grouse in Michigan, pp. 485-490.

First authentic record in 1904. Numbers increased and the bird suffered a drop in population along with the ruffed grouse and prairie chicken in 1932-33. All of these birds are again on the upswing, the sharptail is locally abundant, and the kill in 1937 was around 10,000 birds. Behavior in winter, food habits, and mating activities are described. In a local study, nests were found in clumps of herbs near brush or woodland cover, the average hatching date June 12, and the average clutch 12+. Broods average 7.3 chicks in August. Favored habitat is described and parasites listed. Efforts at artificial propagation have been blocked by difficulty in rearing the young. Notes are given on transplanting experiments. Bibliography of 4 titles.

Life Histories: Muskrat

Enders, Robert K. The corpus luteum as an indicator of the breeding of muskrats, pp. 631-634, 1 fig.

Exact information on the breeding season as a guide to trapping policy is a great need in the fur industry. This study of gonadal development was based on material collected in eastern Maryland. Progressive histology of the ovaries is described and the following conclusions reached: "From the results of these studies it is concluded that in sexually mature Maryland muskrats, ovulation--and hence probably breeding--begins about the first of February. The first ovulatory cycle ends in March and a second begins at once. If the gestation period is approximately 29 to 30 days, as is frequently reported, the time between the onset of the first ovulatory cycle and late March is long enough to enable the animals to produce a litter. If the second cycle is of equal length, three litters could be produced by the end of May."

Life Histories: Prairie chicken

Bennitt, Rudolf. Some agricultural characteristics of the Missouri prairie chicken range, pp. 491-500, 2 figs., 5 tables.

The original distribution of the prairie chicken in the State is discussed, as well as its quondam numbers and their subsequent fluctuations. Results of a census in relation to soil types and land uses are presented in the text, in a map, and in tables. Author's summary: "The kill by man, though illegal, continues to be an obstacle to the recovery of the species. The existence of a cycle has not yet been demonstrated. Since 1900, according to the few records available, the population has fluctuated between a maximum of 12,500 (1907) and a minimum of 5,110 (1934); a marked increase occurred in 1937 and 1938. According to the 1938 spring census, 6,630 birds occupied 1,032 square miles, a density of 6.4 birds per square mile; 5.1 per cent of the potential prairie range was occupied at that time. The distribution was virtually restricted to medium and low-grade prairie soil types, differing from the unoccupied soil types in the following respects: Lower land values and corn productivity; higher per cent of land in sorghums, annual legumes, tame hay (northern Missouri), and wild hay (southwestern Missouri). Essentially the same differences were found on comparing occupied and unoccupied townships on the same soil types. Agricultural trends since 1934 indicate the continuation and extension of these characteristics of the prairie chicken range."

Life Histories: Shoveller

Girard, George L. Notes on life history of the shoveller, pp. 364-371, 4 figs.

Research on life histories as a guide to refuge management as exemplified by a study of the shoveller on two bird refuges in western Montana. Notes on numbers of this species in migration and in the breeding season, proximity of the nests to water (average 61-93 yards), nesting cover used (short grasses 56%), distinguishing hatched eggs from those otherwise broken, predators (re-

loss of
sponsible for/8.45 percent of the total number of eggs), egg laying, incubation and hatching, survival of eggs and young, and food.

Life Histories: Woodcock

Aldous, Clarence M. Studies on woodcock management in Maine, 1938, pp. 437-441.

Third progress report, dealing with singing grounds, nesting cover, abundance, banding studies, limiting factors, and food habits. Of 11 artificially prepared singing grounds, 5 were regularly used.

Management: Clearing

Burlington, H. J. Land-clearing for wildlife in southern New Jersey, pp. 546-548, 4 tables.

Experience proved that maintenance of food patches increased carrying capacity for bob-whites on marginal lands, the dominant vegetation of which is described. Clearing areas for the patches by conventional methods required 146.9 man-hours and 41.9 tractor-hours per acre from woodland to seedbed. Using a brush-cutter greatly reduced these items, the work averaging in 3 instances, which are tabulated, 17.4 man-hours and 9.6 tractor-hours per acre. The brush-cutter method is by far the most economical.

Management: Farmer-sportsman relationship

Benjamin, J. R. The Ohio plan of State-supervised hunting on private lands, pp. 635-644, 2 figs., 6 tables.

Organization of the Bureau of Game Management, Propagation, and Protection and of its campaign to improve farmer-sportsman relationships in the State. Notes on agreements between the parties concerned and on operations under the supervised hunting plan. Author's summary:

"1. The State Supervised Hunting Association Areas are proving beneficial to everyone concerned. The landowners are gratified with the orderly harvest of only the surplus of game each year, without damage to property or danger to livestock. From the fifteen areas operated during the 1938 season there was not a single complaint of property damage, livestock injury or personal danger to farm residents. The sportsmen were pleased with the privilege of hunting where they were welcomed and game was assured. They were enthusiastic over the feeling that there was no danger of their being ejected for trespassing as long as they stayed within the boundaries of the Association Area. The Conservation Division was well pleased with the knowledge of a service well rendered to its constituents.

"2. The principle of 'first come, first served' was strictly adhered to. No permits were issued in advance and no favoritism or exclusiveness was permitted. The emphasis was placed on service to the general public.

"3. True cooperation was emphasized, with the landowners furnishing the land and the game crop; the hunters doing their part by complying with the rules of good sportsmanship and the regulations printed on the permit tags; and the

Conservation Division serving as intermediary to bring the two groups to a mutual understanding and to finer relationships.

"4. No limits were set as to size of areas, but as a general rule they should not be too small to justify the full time services of a checking station attendant and a patrolman, nor so large as to encourage hunters' poaching around the edges rather than going to the central checking station.

"5. In cases where similar groups are organized in the future by private persons, they must adhere to the above principles in order to secure the approval and support of the Conservation Division. A small fee might be permissible, but only an amount sufficient to pay for the cost of supplies and the hiring of the limited personnel necessary to operate the area.

"6. The Conservation Division plans to carry the program through the 5 years contracted for, in order to accumulate data on which general recommendations can be based and to demonstrate the method to as many groups as possible. By the end of that period we can make more general suggestions for plans to be presented to private groups who might want to adopt the system in their local communities.

"The plan has proven to be flexible, economical and extremely popular as at least a partial solution of the problem of finding better places for more sportsmen to hunt under favorable conditions for everyone concerned. It is not copyrighted, but is offered to any group who may wish to adopt it, as being a plan of farm-game harvest that has been tried and NOT found wanting."

Management: Farmer-sportsman relationship

Leopold, Aldo, George M. Wood, John H. Baker, Walter P. Taylor, Lester G. MacNamara, Harold Titus, G. W. Bradt, Justus H. Cline, and Walter F. Kirk. Farmer-sportsman, a partnership for wildlife restoration, pp. 144-166, 176-192.

Leopold. Discussion of changes that have taken place since the adoption in 1930 of an American Game Policy, under the headings used in that document. Three of them relate specifically to the topic of debate. The 1930 policy advised recognition of the landowner as the custodian of public game, but the idea is still more of a hope than a reality. Rather States are now urging farmers not to post lands and are offering free game birds and eggs and grain for winter feeding to keep them from posting. Good wildlife habitat, necessary to steady wildlife production, can be achieved only by conscious effort, however, and it is not likely that farmers are going to create food and cover for wildlife unless they have the final word as to who hunts and how much. Wildlife cropping must grow from inner convictions and these are not to be immediately implanted. Of numerous local trials of farmer-sportsman game management most have come to grief. Some persist as research units but a few survive by reason of their merits. Ohio and Texas examples are cited.

Other topics discussed are indicated by the headings: Extend public ownership and management of game lands; train men, find facts; recognize the protectionist and the scientist; provide funds.

Wood. Legal discussion of game as property of the State, the landowner having no peculiar rights in it, but in fact being in position to control its

taking through trespass prohibitions. The general rule is that no person has any right to enter the land of another without his consent. Difficulties have arisen from sportsmen ignoring that rule and from their deeds too often verging on vandalism. Fair dealing would have contributed to a happier relationship.

Baker. Reprint of this contribution under the title "No wonder the farmer's frantic" was abstracted in WILDLIFE REVIEW, No. 20, May 1939, p. 23.

Taylor. So much of the area available for game management being in private ownership, the movement, to be a success, must devote especial attention to these lands. Taylor discusses a program under 9 headings stated as principles. Wildlife should be considered in farm planning so far as warranted by economic considerations. Continuous research and extension are necessary. The optimum not the maximum head of game should be the objective. Protection of environment from destructive influences is required as well as positive improvements. Among the latter, providing good headquarters cover so as to increase coveys of quail, and diversification of both farm and natural crops are recommended. Harvest must be regulated so as to assure preservation of seed stock. In some way, although not necessarily by cash payment, the sportsman must make it worthwhile for the farmer to produce game. Technically trained game managers should be more widely employed by groups of landholders where individual estates are not large enough to warrant the expense. Non-game species should not be neglected; in fact the whole ecological complex should be considered and natural methods preferred. "Emphasize the essentials. But what are the essentials? They may and probably should differ according to conditions. For everyone, everywhere, it appears that the provision of food and cover and protection, and further research are essentials. Importation of exotics, killing of fur animals hawks or owls, extensive plantings, expensive propagation, do not impress modern game managers nearly so much in the big program as the protection of valuable species, the conservation of native wildlife, saving the soil, and conserving the natural vegetation."

MacNamara. In New Jersey the incentives for the farmer to produce and maintain game are mainly: (1) Monetary profit; (2) his own hunting pleasure; (3) value of certain species of game in insect and weed control; and (4) protection afforded by an organized relationship between farmers and sportsmen. The laws provide for sale under license of artificially or naturally propagated game but only a very small percentage (1.5) of the landholders take advantage of the opportunity. Farmer-sportsmen clubs, another arrangement tried, succeeded to about the same extent. Distribution of pheasant eggs to stimulate artificial propagation proved unproductive and was discontinued. To convince farmers that game crops can be produced by agricultural methods and provide supplementary income, education and particularly demonstration is required. With that in view, the State Fish and Game Commission in 1936 established a demonstrational area including a 20-acre refuge surrounded by 500 acres open to hunting. Post-season counts in 1937 and 1938 indicated that pheasants and rabbits survived in sufficient numbers to make restocking unnecessary. It is believed that the plan can be extended by leasing unused bits of farm lands as refuges and permitting hunting on adjacent acreage.

Titus. In Michigan the private shooting preserve act [similar to one now in effect in New Jersey] was repealed because of resentment of sportsmen over the more liberal shooting privileges permitted on these areas. Michigan has an effective trespass law but probably not more than 20 percent of the landowners refuse permission to hunt except on the overcrowded opening day. Pheasants follow good soil, hence the cost of public shooting grounds is prohibitive. Competition may prevent hunting always where one pleases and the situation is hardly worse on farmed than on wild lands. The take of farm game is high in Michigan and the speaker believes that the situation is not so bad as indicated by the complaints of hunters.

Bradt. The Williamston plan of cooperative hunting control was started in Michigan about 10 years ago and has steadily gained new adherents. The plan has 3 basic features. "The first one is that a group of farmers post their land as a unit, using uniform signs instead of individual No Hunting signs. Hunting is by permission ticket only. The hunter has to drive in the farmer's yard, ask for permission to hunt, and if he gets it he receives a ticket which gives him permission to hunt on whatever area the farmers have agreed upon. He leaves his car 'in hock' in the farmer's yard. That is very important. While he has that ticket the farmer has his car. When he is finished hunting and turns in his ticket the farmer then lets him take his car." Nearly a hundred clubs dealing with about three-quarters of a million acres are being operated under the Williamston plan. Eighty-five percent of the farmers favor the plan, while 15 percent are more or less dissatisfied. Hunting pressure is reduced and local hunters have an advantage in lessened competition that they appreciate. Farmers become interested in game and think less about trespass troubles. Difficulties are chiefly due to failure of participants to live up to the rules. Hunters go in too large parties and take too many dogs; these things result in denial of permission to hunt. Various human and essentially uncontrollable factors hamper the system; in general it works best at a distance from large cities. Fees are objectionable to farmers as after paying them some hunters think they "run the place"; nor do farmers want pay from the State Department of Conservation because that would give it "a finger in the pie." Farmers wish to run their own business and keep everybody else out.

Cline. The destiny of wildlife is in the hands of the landowner. The two most important landowners are the farmer and the government (Federal or State). The government should set the example in wildlife conservation and management. The farmer, as a rule, though a conservationist is not a sportsman. He is primarily concerned in making a living from the land and in a majority of instances is having difficulty in doing it. He cannot afford to produce wild, in preference to domestic, stock, as he does not have the same property rights in it and cannot, therefore, derive an assured income from it. Plans for solving the difficulty do not seem to work very well as they do not coordinate the various interests legitimately concerned. Farmers can be interested in a genuine broad-guage program of conservation and will welcome cooperation of sportsmen toward that end.

Kirk. The farmer is a modest capitalist whose investment is in the acres from which he must wrest his livelihood. He works for about 20 cents an hour and must buy things produced by labor paid for at from 50 cents to a dollar

an hour; he is in rather an impossible economic position. He, however, produces game and the sportsman who wishes to hunt it contributes little. The hunter's license fees and other expenditures give him no rights over the game nor no privilege of entering private property. These things are not said unkindly but only that the thing may be seen as it is. The farmer is interested in broad conservation in which the things that seem of most concern to sportsmen are just a part and maybe a small part. A great deal depends upon the attitude of those who approach the farmer, but the latter, granted fair treatment, will be glad to discuss the problems of wildlife propagation, better conservation methods, and a united program.

Management: Farmer-sportsman relationship

Short, Alexander W. Improvement in farmer-hunter relations in Ohio, pp. 514-518.

Review of conditions that led to general posting of farms in Ohio. Appointment of game management agents and direction of their services toward alleviation of the situation. From author's abstract: The problem is one of education. In the Ohio program, the farmer comes first, the farm youth second, and the sportsman third. The attitudes of farmers are being improved by (1) the formation of sportsman-farmer organizations, with farmers constituting 50% of the membership, (2) subsidizing wildlife improvements on individual farms through the AAA program, (3) educating the county agents so they in turn can carry the message of conservation to the farmer, and (4) the use of game management agents to assist farmers in producing crops of wildlife. Farm youths are being educated by: (1) Weaving conservation principles into all school courses from grade school through high school, (2) introducing project work in game management by FFA and 4-H Club boys and girls under supervision of game management agents, and (3) sending outstanding boys and girls in 4-H Club work to participate in a full week conservation course at an outdoor camp. Sportsmen's organizations are working for better understanding with the farmer by: (1) Subsidy of food and cover improvements on farms, (2) actual participation of the club members in making improvements, and (3) by payment of small fees to the farmer for the privilege of hunting. In the Ohio game management program, production is guaranteed through habitat improvement and protection, and the harvest is regulated to the satisfaction of all by several methods of controlled hunting.

Management: General

Day, Albert M., Carl D. Shoemaker, and P. J. Hoffmaster. Is the Pittman-Robertson Act functioning properly for wildlife?, pp. 12-24.

Day. In the first 7 months of the functioning of the Act, all but one State filed intentions to participate, 7, however, requiring some legislation before they could comply with the provisions of the Federal law. Twenty-eight States had submitted 50 projects of which 24 had been approved. The nature of these is discussed; they involve purchase of lands, development of areas for wildlife, and study of management problems. The sums involved and accounting requirements are briefly stated.

Shoemaker. Remarks upon passing of the Act and suggestions for supporting legislation.

Hoffmaster. The functioning of the Act should result in States becoming better informed about work in other States; under central coordination, provincial attitudes should be modified, and the number of plausible but worthless undertakings should decrease, including those mistakenly urged by influential local groups.

Management: Harvesting antelopes, Oregon

Einarsen, Arthur S. Oregon's open season on antelope in 1938, pp. 216-220, 1 table, 1 map.

Author's abstract: "Oregon held an open season on antelopes in 1938 from October 28 to November 1, inclusive, on a controlled plan. For the past twenty-five years the taking of antelopes had been prohibited. Results of the open season proved that these shoots must be controlled. Hunter success was 72.34 per cent efficient; 242 hunters bagged 175 antelopes. Bucks and does were taken in equal numbers. The regulations should limit each hunter to one antelope. Seasons should be short, as the animals congregate in over-increasing herds as the open season progresses. The number of persons in hunting parties should be less than four. The season in Oregon should fall between October 1 and 15. Unit hunts permit orderly game cropping, with limited personnel. Rules for hunting antelopes should encourage skill in stalking, as random long-range shooting results in waste. Guns with a bullet having 1400 foot-pounds energy or more at 100 yards should be used."

Management: Harvesting deer, Wisconsin

Sanders, Roy D. Results of a study of the harvesting of whitetail deer in the Chequamegon National Forest, pp. 549-553, tables.

On this forest of more than a million acres, the deer population is estimated at 50,000. Drives revealed the animals in numbers from 2 to 272 per section. In severe weather the deer are restricted to 6.1 percent of the gross area of the forest, the average estimated concentration being from .56 to 2.4 deer per acre of wintering yard. Overpopulation impends and special open seasons have been arranged to prevent it. The article is mainly a summary of data obtained through checking stations for hunters in 1937 and 1938. This information includes number of hunters, legal and illegal kill, daily bag, time required to get a deer, success ratio, methods of shooting, caliber of weapons, and wastage (37%).

Management: Herd regulation

Dixon, Joseph S., and E. Lowell Sumner, Jr. The deer problem, deer trapping, and deer removal at Zion Canyon, Utah, pp. 231-235, 2 tables.

When Zion National Park was established in 1918, much of the natural forage had been destroyed by cattle. After 10 years of protection, the canyon

floor was again covered by vegetation and fully restocked with deer. The deer further increased and overbrowsing ensued. Mortality became abnormally high./ As hunting on surrounding areas did not effectively reduce the herd, trapping was resorted to and the animals released where they were wanted. Methods are described.

Management: Inventory, cottontail

Hendrickson, George O. Inventory methods for Nearns' cottontail, pp. 209-215, 4 tables.

Author's abstract: "An inventory of cottontails in July is desirable in Iowa because the shooting season opens August 1 unless the Conservation Commission finds the population too low. The fecal pellet count to a square foot of feeding range with one cottontail to an acre was computed as 0.66 pellet, accumulated for three months, May-July, from a base figure of 320 pellets, the average for one cottongail in 24 hours as found with caged animals, two adults and one juvenile, on succulent summer diets. The fecal pellet count to one square foot at 1.5 rod intervals with one rabbit to an acre was 0.52 pellet late in July as counted on feeding ranges of 22 observed cottontails, 1935-38. The variations between the average square foot pellet counts for the 22 rabbits and the expected 0.66 were not significant statistically. Hence 0.52 pellet was taken as an index of one cottontail to one acre of feeding territory late in July.

"In Davis County, southern Iowa, the average count was 2.35 pellets to a square foot, which indicated 4.5 cottontails to the acre of feeding range. Driving by automobile for five-mile trips at various times of day, the writer saw most cottontails at 6:15-6:30 a.m. Along the sides of the road, feeding cover such as tall grasses, small grains, and legumes with shrubby or weedy cover was found on 0.39 of the acreage within 20 rods of the road. The expected number of cottontails to one mile of road was computed as 140, and an average of three to a mile was seen at 6:15-6:30 a.m. The ratio was 3 seen to 140 expected or 1:46. In Boone County, central Iowa, the average count of 0.66 pellets to a square foot indicated 1.2 cottontails to a feeding acre. In that county along the sides of 3.2 miles of road, 0.47 of the acreage within 20 rods was considered to be supplied with protective and feeding cover for cottontails. The expected number of cottontails to a mile was 45 and an average of 0.75 cottontail was seen in auto drives at 6:15 a.m. The ratio is 0.75 seen to 45 expected, or 1:60 for an estimated population of 1.2 cottontails to an acre.

"That dew conditions should be considered was recognized for in walking one of the 3.2 miles in Boone County at 6:30 a.m. for seven mornings, an average of 4.7 rabbits were seen when there was heavy dew, approximately two was the average seen when dew was medium to light on 12 mornings, and an average of 0.6 was seen when dew was not discernible. Beating buckbrush, with bluegrass undercover, in the heat of afternoons, yielded four cottontails to an acre in Davis County, whereas beating thickets in Boone County yielded none. In mid-December tramping through feeding cover such as ungrazed woody bluegrass, buckbrush and bluegrass, and cornfields yielded an average of approximately three cottontails to an acre whereas in Boone County only 0.08 to an acre was the average."

Bibliography of 4 titles.

Management: Inventory, deer

McCain, Rendel. The development and use of game drives for determining whitetail deer populations on Allegheny National Forest, pp. 221-230, 2 figs., 1 table.

Description of this Pennsylvania forest. The deer herd was estimated at 40,000 in 1938, probably three times the number that can be maintained on the depleted range. Losses from all causes in the same year were 27,000. Qualifications of satisfactory game drive areas are cited and the method of driving described. Crews of CCC workers 100 or more in number were employed. Doing the work in this way is expensive and it is hoped that a more economical means will be found. The table gives the results of drives held from 1935-38, inclusive, in terms of acres per deer. Estimated total populations and losses from 1934-38 also are given. Bibliography of 7 titles.

Management: Planting aquatics

Sharp, Ward M. Propagation of Potamogeton and Sagittaria from seeds, pp. 351-358, 4 figs.

For practical large-scale handling of the seeds of duck potato (Sagittaria latifolia), sago pondweed (Potamogeton pectinatus), and flat-stemmed pondweed P. zosteriformis), it was necessary to develop methods different from those previously recommended. These are described, including harvesting, preparing, storing, testing, germinating, and planting.

Management: Planting for wildlife and erosion control

Edminster, Frank C. Hedge plantings for erosion control and wildlife management, pp. 534-541.

Author's summary: "Planting and care of hedges is a valuable tool for soil conservation and wildlife management. A managed hedge is quite different from an ordinary wild hedgerow and its values and requirements should be explained to the farmer with great care. Hedges are most valuable when planted on the contour and may be located along contour fences, on other contour field boundaries, at the top of the filter strips above diversion terraces and on other strategic contour lines. A number of woody plants may be used for hedge plantings that will produce a low, thick-growing stand requiring little maintenance. Two or more species should be used in each hedge, planted in a double row with staggered 2-foot by 2-foot spacing. From 200 to 600 feet apart is a desirable spacing of hedges on a slope. Some maintenance will be required just as with any other farm crop. By proper planning, hedges may be used to the greatest possible benefit of the land and its products."

Management: Planting for wildlife and erosion control

Franklin, Sydney. Mulching to establish vegetation for wildlife and erosion control, pp. 508-513.

Author's abstract: "Within the past five years, the Soil Conservation Service has developed and put into use, especially in the Southeastern States, the practice of mulching eroded areas as an aid to establishing erosion-resisting vegetation desirable for wildlife habitat improvement. This paper defines mulching and discusses (1) the purpose of its use, (2) kinds of mulch--plant litter, mulch crops, (3) methods of application--simultaneously with seeding, premulching, (4) cost of application, (5) benefits to wildlife, and (6) farmer response to this method of establishing a dual-purpose vegetative covering for gullies and other severely eroded areas." Bibliography of 5 titles.

Management: Planting for wildlife and erosion control

Graham, Edward H. Legumes for soil and wildlife conservation, pp. 501-507, 4 tables.

Herbaceous legumes can be sown by direct seeding, do well on impoverished soils, which they improve, and are of considerable value in producing food for wildlife. Author's abstract: "The paper describes the use of leguminous plants by the Soil Conservation Service in its erosion-control program and shows how the species used are contributing to the improvement of wildlife habitats on agricultural land. The wildlife utilization of important erosion-resisting crop legumes is treated. Tables are presented, based upon a review of the literature and Bureau of Biological Survey stomach records. Tables 1 and 2 show the 15 genera and 10 species of legumes most utilized by wildlife for food, with the numbers of birds and mammals known to use each. Tables 3 and 4 list the 10 birds and 10 mammals which use leguminous plants most, with the numbers of legume species utilized by each. An interpretation of the table follows, in the light of the use that can be made of legumes by the wildlife manager and soil conservationist." Bibliography of 15 titles.

Management: Pond development

Allen, Philip F. Development of ponds for wildlife in the southern high plains, pp. 539-542.

In this arid country the development of stock watering ponds offers, perhaps, the best opportunity of aiding wildlife. The cattle industry, wildlife management, and erosion control all are benefitted by maximum distribution of ponds. For wildlife, watering places with the vegetation that can be developed in and about them provide interspersion of food, water, and shelter favorable to more complete occupancy of the range. Vegetation protects ponds by trapping silt, reducing wave action, and protecting banks from burrowing rodents. Plants suitable for growth in the water and on the banks are suggested. The areas must be fenced, access for cattle drinking being allowed for, or better the water being piped to a separate drinking place. Hundreds of ponds are being developed. The response of wildlife, especially aquatic species, is gratifying.

Management: Pond development

Davis, C. M. Development of ponds as wildlife areas in Missouri, pp. 519-524.

A pond can be made one of the most useful parts of a farm, not only for storage of water for livestock, but also for wildlife utilization and erosion control. This article contains some hints on the construction of ponds but dwells mostly on factors improving them for wildlife, as fencing, providing windbreaks, making fish shelters, planting food and cover for both terrestrial and aquatic wildlife, and introducing vegetation to control silting and wave action. Lists are given of plants suitable for use in Missouri as silt strainers and bank binders, and for water and shore planting. The desirability of winter feeding also is mentioned.

Management: Quail, Valley

Dill, Herbert H. Winter feeding and shelters for the California valley quail, pp. 474-477.

At the Tule Lake Wildlife Refuge, feeders were operated in connection with shelters impenetrable to predators. Hawks caught quail at the feeders but this could be prevented by moving them to dense cover. Author's summary: "(1) California valley quail will readily use shelters and feeding stations. The lean-to type built at the Tule Lake Refuge has proved very satisfactory; (2) as the quail thus readily consumed a large quantity of the food offered they probably entered the nesting season in a healthy condition, a better natural reproduction being thereby insured; (3) an abrupt decrease in the quail population occurred in spite of protection from hunters, the providing of food and shelter, and the control of predatory animals; (4) the loss of quail through certain predators during periods of heavy snow at Tule Lake was severe. Control measures and the furnishing of artificial shelters lessened the injury."

Management: Refuges

Henry, Cordie J. Response of wildlife to management practices on the Lower Souris Migratory Waterfowl Refuge, pp. 372-377.

The Souris River valley in North Dakota was originally a paradise for waterfowl but desiccation and drainage practically ruined it. Rehabilitation by the Biological Survey begun in 1935 has embraced water impoundment, fencing, control of blowouts in sandhills, planting of cover and food, construction of nesting islands, and control of predators. Notes are given on the succession of vegetation after flooding, the response of wildlife to the environmental alterations, and destruction of nests by predators. "The program at the Souris Refuge is directed toward a land use policy of maximum benefit consistent with the greatest possible production of desirable forms of wildlife. Success is clearly evidenced by the great flocks of birds that use the refuge in ever-increasing numbers. The general appearance of the area is gradually changing and the refuge is beginning to resemble the famed marshes described by our forefathers."

Management: Refuges

Smith, Robert H. Wildlife management practices for overflow areas of the lower Mississippi River region, pp. 395-399.

Too much shooting, deforestation, unrestricted ranging of livestock, and increased height and duration of floods have greatly depleted wildlife in the bottoms. Management as practiced on the White River Migratory Waterfowl Refuge in Arkansas is described with the suggestion that it may be applicable, more or less, to extensive similar areas. Plans must be made for adequate environment at times of both low and high water. In the development of low-water feeding areas, marsh plants are propagated on dry lake beds protected from ordinary rises of the river by dams. Chufa and wild millet are the most important foods in these places. To render the food available to waterfowl, the lakes must be reflooded by October 15; this is provided for by impounding water. At high water periods, waterfowl spread through the flooded woodlands to feed and plantings are being made to increase the food producing capacity of these tracts. Minor management suggestions also are made. The wildlife of the area and its reactions to changes in water level are described.

Management: Refuges

Stoenis, John H. Marsh management on the Great Plains waterfowl refuges, pp. 400-405.

Restoration of areas in this former important breeding ground for waterfowl includes impoundment of water, and the collecting, storing, and sowing of propagules of valuable plants. Progress in the handling of propagating material by the aid of relief labor is described. The species utilized and the best methods of gathering, storing, and planting each are discussed.

Management: Refuges

Towle, Robert E. Managing a western reclamation project for wildlife, pp. 383-388, 2 figs.

Plans for water regulation, planting, and management of Muddy Creek valley at the upper end of Lake Mead, Boulder Canyon Wildlife Refuge, Nevada.

Management: Stocking ducks

Benson, Dirck. Survival studies of mallards liberated in New York State, pp. 411-415, 3 tables.

Description of 5 areas on which releases of artificially propagated stock were made, and discussion of one season's results. The breeding success of the birds is presented in table and text, and also compared with that attained by black and wood ducks (mallard poorest of the three). Ducklings of varying age were released on 3 of the areas and the percentage of their survival rose with their age at time of liberation.

Management: Stocking, partridge, chukar

Nagel, Werner O. A preliminary report of the chukar partridge in Missouri, pp. 416-421.

Having on hand some hundreds of birds, it was decided to use them experimentally to determine the adaptability of the species to Missouri conditions, the relation of the partridge to other species, and its qualifications as a game bird. The plan of the study and the areas concerned are described. Density of release has been a bird to about 10 acres. Bands were applied to permit tracing of individuals. Of 1,350 partridges released, 84 were found dead. Predators killed 58 (foxes, 18; hawks, 16; house cats, 10); disease, 11; accidents, 6; and hunters, 3. Among a thousand birds liberated, 9 percent (46 pairs) nested and produced 430 young (average number per pair 9.3). Notes are given on diseases, food, and certain habits. No conflict with native species was observed. Figures are presented showing "survival" rates for both adults and young but their true significance is obscured because part of them (disappearance of whole coveys) probably do not represent actual losses. Suitability of range is discussed and the conclusion drawn that the mixed prairie and woodland area is best. Restless movement of entire coveys seems to be characteristic.

Management: Stocking, trapping pheasants

Hicks, Lawrence E., and Daniel L. Leedy. Techniques of pheasant trapping and population control, pp. 449-461, 2 figs., 1 table.

"Pheasant crops of the size demanded by present hunting pressures are produced only where every section of land contributes to that end." Methods of dispersing pheasants from refuges are discussed, of which trapping is the best adapted for restocking underpopulated areas. The average cost of trapping per bird for the past 5 years was 54.6 cents. The history of pheasant trapping in Ohio is related, and its advantages are discussed. Construction of traps is described and illustrated. Operation of the traps, handling the catch, transporting and releasing the birds, mortality associated with trapping, and selective trapping also are treated. Bibliography of 18 titles.

Management: Swan, Trumpeter

Hull, A. V. Trumpeter swans, their management and preservation, pp. 378-382, 1 table.

Trumpeter swans, restricted to 3 colonies, are now protected in all, the last to be guarded being that on Red Rock lakes, Montana. Their presence was the leading reason for making this area a migratory waterfowl refuge. Sedentary habits of the birds contribute to their protection and the chief need is management that will increase their numbers. The swans use muskrat lodges as supports for their nests and artificial nesting sites modelled after these structures are being multiplied; small nesting islands also are being provided. The birds are given full protection and privacy. Strict coyote control is exercised to save as many as possible of the swans and their young. Winter feeding is done on a large scale and additional feeding places will be developed. The article includes notes on the life history of the swans and the results of counts of trumpeters in the Red Rock Lakes and Yellowstone Park areas in 1936, '37, and '38. Respective totals: 108, 158, 148.

Natural History: Indication of age

Gower, W. Carl. The use of the bursa of Fabricius as an indicator of age in game birds, pp. 426-430, 2 pls.

The bursa of Fabricius (described and illustrated), apparent only upon dissection, is a dependable character for distinguishing birds of the year (7-9 months) from adults.

Propagation: Irradiation results

Bump, Gardiner, and Leonard Clark. Responses of game birds to irradiation, pp. 442-448, 3 figs.

Review of literature of which 8 titles are cited. The studies were planned to test the effects upon game birds of intensity, periodicity, and duration of artificial lighting. The conditions of the experiments are described and the results presented in graphs and text. Authors' summary: "To sum up, a moderate amount of light over and above normal stimulates reproductive activity among pheasants, quail and grouse during most periods of the year. Artificial conditions, exposure to an intensity of 5 f.c. continuously in the absence of daylight, or for a relatively short period (3 hours) in addition to normal daylight, so stimulated the gonads as to produce the largest number of fertile eggs from pheasants. Periodic illumination is more effective than continuous lighting. Exposure to alternate one-hour intervals of light and dark gave best results. It is possible that principles here indicated may serve to further clarify our understanding of the limitations surrounding the breeding range of certain species, as well as the beginning and ending of the period of egg production among many species in the wild."

Research: Bob-white's resistance to cold

Gorstell, Richard. Certain mechanics of winter quail losses revealed by laboratory experimentation, pp. 466-467, 1 table.

Extremely severe winters that occur about every 20 years decimate bobwhite populations. Experiments were conducted to learn the reaction of the birds to cold. Characteristics of the quail huddle, and results of the experiments are described. The author's tentative conclusions are: "(1) That the characteristic huddling habit of the bobwhite quail may at least in part represent an instinctive reaction which tends to reduce the heat loss from the bodies of the various individuals which make up any given covey; (2) that, at least within certain limits, the ability of a covey of quail to withstand low environmental temperatures is directly proportional to the size of that covey; (3) that the body temperature of individual quail may drop more than 25° F. below normal without the bird's suffering a breakdown of its thermal regulatory system which would result in death.

"In closing, it seems fitting to call to the game manager's and sportsmen's attention the practical importance of the results obtained even from the few experiments so far completed. This lies in the indication that throughout

the northern portion of the quail range, the bobwhite coveys should not be shot down to a point where their chances of winter survival are seriously endangered simply by too great a reduction in the average size of the bevies."

Bibliography of 7 titles.

Research: Bob-white's response to predation

Errington, Paul L. Suggestions for appraising effects of predation on local areas managed for bobwhite, pp. 422-425.

Abstract, chiefly the author's: Much variation in response of bob-white populations to changes in densities of chief predatory enemies has been recorded in recent literature, 5 titles of which are cited. In analyzing these problems, experimentation on the land appears to show increasing promise of contributing significantly to our knowledge. This is especially true as concerns many of the complexities of quail-predator relationships, but work on these, to be scientifically acceptable, must be done with due awareness of important possible sources of error. Much inconclusive groping and misinterpretation of results may arise from confusion of primary and secondary types of predation, lack of correlation of predation with population phenomena of prey species, and failure to distinguish between actual changes in prey population levels following changes in kinds and numbers of predators and mere reorientation of prey populations on a local scale. Study areas should be of sizes that include the full ranges of most of the coveys present.

Research: Experiment station

Allen, Durward L. A new wildlife experiment station near Allegan, Michigan, pp. 628-630.

Swan Creek Wildlife Experiment Station on a 35,000-acre leased tract that was purchased and developed by the U. S. Department of Agriculture in connection with its land utilization program. Notes on ecology of the area and on the program of investigation; management studies of the cottontail and raccoon first, and of the fox squirrel and pheasant later. Management procedure proved practicable here can then be extended to suitable areas elsewhere in the State.

Research: Tracking

Stebler, A. M. The tracking technique in the study of the larger predatory mammals, pp. 203-208.

Usefulness of the technique is limited chiefly to regions and seasons having good snow cover. Granted that, the study amounts to almost the same thing as observing the animals themselves and contributes to knowledge of populations, sex ratios, breeding periods, denning habits, territories, and feeding habits. Suggestions are given on identification of tracks by their size and shape, by the odor of urine at scent-posts, and of the animals themselves. Other hints relate to determination of the number of animals making a trail and of those frequenting an area; to detection of the sexes and of sexual phenomena; and to food and feeding habits. Bibliography of 6 titles.

Research: Trapping, Pennsylvania

Wade, Douglas E. Economic survey and general inventory of native Pennsylvania fur-bearers, pp. 250-252, 1 table.

Preliminary report on a study of trapping in Snyder County, an area comprising 0.68 percent of the surface, and 0.19 of the population, of the State. Information gained by interviewing representatives of all families in the County reveals their activities in trapping, including trapper-family ratio, average age of trapper, proportion of licensees, number of traps, catch and its disposition, and income.

SPECIAL ARTICLES

Following are summaries of unpublished theses offered in partial fulfillment of the requirements for MS degrees by graduate students in the Alabama Cooperative Wildlife Research Unit at the Alabama Polytechnic Institute. They were submitted by Dr. Allen M. Pearson of the Biological Survey.

The conservation of wildlife in Alabama: A synthesis of materials for high school biology, by Julian C. Ivey. August 1936.

It should be borne in mind that the following is a summary of conditions, and does not represent conclusions. To the extent that the evidence permits, each section is an attempt to answer briefly the question raised in each problem.

PROBLEM 1. WHAT IS "CONSERVATION OF WILDLIFE"?

The most commonly accepted idea of the principle of conservation of wildlife is wise use of all of our wild bird, mammal, and fish life; its meaning is much broader than protection. Conservation of game is a narrow term, applying to the small percentage of wildlife classed as game species. Wildlife management and game management are applied sciences which seek to produce annual crops of wild animals for man's benefit in various ways.

PROBLEM 2. WHAT IS THE IMPORTANCE OF ALABAMA'S WILDLIFE RESOURCES?

Although possessing a variety of surface features, Alabama lies chiefly within one life zone, the Lower Austral. Its fauna is not as varied as that of some neighboring States, but it exceeds in the abundance of several species. The values of wildlife are chiefly for food, fur, recreation, and regulation of natural balance. Alabama shares in a nation-wide increase of hunting and fishing, whose decline for lack of game would affect many industries. The value of many non-game species is not sufficiently recognized, although it has been proved by research.

PROBLEM 3. WHY IS CONSERVATION OF WILDLIFE NECESSARY?

Man's policy in the past has caused the extermination of several formerly abundant species, and now threatens the existence of others, including migratory waterfowl, big-game, fur-bearers, predatory birds, and other non-game species. The decrease in wildlife due to direct killing and to destruction of habitat threatens an annual return estimated at a billion dollars. Factors contributing to destruction of habitat are: Deforestation; agricultural practices, including

grazing and forestry methods; fire, an acute problem in the South; soil erosion, both a cause of decrease and a fellow-symptom of cover removal; drainage, especially affecting waterfowl; and stream pollution, largely by industrial waste, for the control of which comparatively little has been done. Menaces to wildlife include: Increasing number of sportsmen, due to increased leisure and improved transportation; unsportsmanlike practices; improved weapons; general lack of respect for game laws; domestic animals, chiefly the cat; and diseases, especially serious at game farms and hatcheries. Weaknesses in the conservation field include: Conflicting administrative policies; non-cooperation between States; lack of a national game policy; clashing viewpoints of groups interested in conservation; and unscientific administration of wildlife resources.

PROBLEM 4. WHAT NATURAL FACTORS MUST BE CONSIDERED IN CONSERVATION?

The abundance of a species of wildlife depends upon the interaction of two opposing forces. One, the reproductive capacity, would bring about an amazing increase of a given species if the other, resistance of the environment, were removed. Natural checks such as normal wastage, accidents, diseases, and predators, together with unfavorable food and cover conditions, seem to set a limit to the number of a species on a given area. By regulating the resistance of the environment, man can produce an annual crop of game or fish for his own use. The environmental factors are so numerous and complicated that game and fish management require much additional research. One little-understood phenomenon is cycles, or periodical fluctuations in wildlife population. Under the condition known as the balance of nature, variations in relative numbers remain fairly constant over long periods. This balance is brought about by the various species acting as checks upon each other. When man decreases some species, introduces others, depletes the environment, or makes conditions temporarily more favorable than natural, the balance is upset. Wide variations in abundance of species then occur, and may become economically harmful. Allowing overcrowding, or decreasing abundance below that necessary to repopulate the environment, are both short-sighted.

PROBLEM 5. HOW HAS THE CONSERVATION OF WILDLIFE DEVELOPED?

Conservation methods seem to have been divided into five phases during written history. In the Old World, conservation of wildlife, chiefly through hunting restrictions, has been recorded since biblical times. Conservation in England and Europe has passed from this phase through the methods of predator-control, provision of refuges, artificial propagation, to environmental controls. Basing our wildlife administration on the English system, except that ownership of wild animals is vested in State instead of King, we have failed to conserve wildlife merely through hunting and fishing restrictions and have permitted predator control to be often unscientifically conducted. Governmental authority and international agreements have been found necessary for the conservation of migratory birds. Provision of refuges and artificial propagation have been especially emphasized during the past century. Recent emphasis is on control of all environmental factors, requiring scientific research and technically qualified administration.

PROBLEM 6. WHAT IS BEING DONE FOR CONSERVATION TODAY?

Conservation efforts are being made by numerous groups, working in many different ways. Governmental agencies with wildlife conservation as a major

objective include the Bureau of Biological Survey, Bureau of Fisheries, Forest Service, and National Park Service. Private organizations are numerous, among which the Audubon Societies and Izaak Walton Leagues are probably best known. Organizations may be actuated by economic, esthetic, scientific, or other motives, often conflicting with each other; recently efforts have been made to unite all interested in conservation in one group, the General Wildlife Federation. Hunting regulations of which farmer-sportsman relationships may be considered a phase, are being increasingly based on scientific study. Recent investigations have revealed new values for animals formerly considered wholly harmful, and control operations are being improved. Increased emphasis is being placed on refuges as a means of insuring adequate breeding stock, and upon reservations as a means of preserving threatened species. Emergency appropriations and a policy of land-retirement have facilitated progress towards a more nearly complete refuge system. Artificial propagation continues to be necessary, with regulation of the environment as a factor often determining success of restocking. Present efforts along the line of environmental improvement include: Cooperative research and demonstration projects at land-grant colleges; the soil conservation program; correlation of forestry and wildlife management; efforts to control water pollution, including surveys and legislation. The importance of biological relationships is being increasingly recognized with research necessary to elucidate them in all phases of conservation. Research in progress includes: Studies of food habits, including forest wildlife relationships; bird banding, to determine migration routes and individual life histories; and research into wildlife diseases. Subjects on which additional investigation is especially needed are: Wildlife cycles; aquatic environments, particularly their food relationships; methods of propagation; and water pollution. Studies of regional problems of wildlife management, seeking to bring about improved general practices, are under way in Alabama and eight other States. Opportunities in game, fish, and other wildlife conservation fields include research, demonstration, and management, for which a lack of thoroughly trained men is at present manifest.

PROBLEM 7. WHAT CAN WE DO TO HELP WILDLIFE CONSERVATION?

In order to aid in solving conservation problems, it is necessary for us to keep informed concerning them and to give them publicity. In our own activities affecting wildlife, we should observe the rules of true sportsmanship. As a basis for intelligent conservation, inventory of wildlife resources is necessary. Such surveys may grow into a systematic study of birds and mammals. Many interesting publications on this activity are available, as well as on attraction and protection of song birds. We may be of very material help in insuring an annual crop of wildlife by maintaining year-round food and cover. Farm practices may be adapted to wildlife; the effort may be repaid in an annual crop of game marketed to sportsmen. Where conditions render it advisable, game birds may be propagated. Marsh and other water areas may be created or improved for waterfowl, fishes, and other wildlife. The study of fishes in relation to their environment may suggest better means of providing for them. Where control of species is necessary, it should be conducted on a scientific basis. Conservation may be given publicity by building up libraries, showing motion pictures, and exhibiting posters.

Recommendations for Further Studies. The writer recommends similar studies in other fields than wildlife conservation. That soil conservation has little up-to-date material suitable for teaching purposes. The problem of stream pollution seems to offer opportunity for emphasis in chemistry and general science courses.

A trial of the materials presented, to determine most effective teaching organization, placement, learning activities, methods of approach, and vocabulary weaknesses would afford opportunity for scientific study. Objective studies might be made in connection with the present curriculum program, to determine phases of conservation suitable for different courses, and methods of correlating them.

A study of conservation elements offered in teacher-training institutions offers opportunity for improving conservation teaching.

The importance of certain woody plants as producers of food for birds in east Alabama, by Elmer A. Jones. August 1938.

According to the number of birds feeding on them, pines, blackgum, and holly were found to be the most important food producers. Eighteen species of birds fed on seeds of pine, 11 on the fruits of blackgum, and 11 on those of holly. Pine mast was available from November to March and the fruits of blackgum and holly from November through April.

French mulberry and smooth-sumac were next in value. Nine species of birds fed on the fruits of these shrubs which were available throughout most of the investigation.

The fruits of oak, flowering dogwood, and Cherokee rose were available from November through March and were eaten by seven species of birds. Cherokee rose, however, is considered a pest in some sections of Alabama.

Four other plants providing food from November through March were patronized as follows: Shag-bark hickory by six species of birds; dwarf-sumac by five; and indigo bush and hawthorns each by four species.

Russian olive ripened in January and remained on the bushes until the middle of April. The fruits were taken by five species of birds. Those of sugarberry, privet, and Japanese strawberry were consumed by three species of birds and were available from November through February.

Tulip-poplar, smooth alder, chaste-tree, and honeylocust were the least important food plants studied. Tulip-poplar and smooth alder seeds were observed eaten by only one species of bird each, while chaste-tree and honeylocust were not recorded as taken by any bird. The fruits of these four trees were available over a long period.

Studies on the food habits of the white-tailed deer in Alabama, by Dyer N. Rugglos. August 1938.

1. A study of the foods of the white-tailed deer was conducted in Sumter County in western Alabama.

2. The range on which the studies were carried on was well stocked but not overpopulated by deer.

3. Greenbrier was the single most valuable deer food for the year 1936-37.

4. Dwarf sumac also was important, ranking second only to greenbrier.

5. The oak family (Fagaceae) contributed more of the volume of deer food than any other single family.

6. Acorns were a preferred food and the deer ate them as long as they were available.

7. Broadleaved trees as a whole ranked higher than any other group of deer foods. Five other groups, listed in order of importance, were: vines, shrubs, conifers, herbs, and grasses.

The value of certain agronomic plants as food for bob-whites, by James W. Webb. May 1939.

1. Experiments were conducted over a two-year period with 30 species of plants to determine the value of each as an agronomic food crop for bob-whites in Alabama. Three plantings were made of each species each year at the main experiment station, and also at the Black Belt, Sand Mountain, Tennessee Valley, Wiregrass, and Gulf Coast substations, and in the experimental fields near Browton. Observations were made at monthly intervals to determine desirable and undesirable qualities.

2. The plants found to be of most value for use in food patches for quail are listed in the order of their importance for three districts:

(a) Appalachian Mountains and Limestone Valley Soil Provinces: Korean lespedeza, common lespedeza, browntop millet, German millet, Texas millet, Laredo soybean, amber sorghum, sagrain sorghum, mung bean, Brabham cowpea, benc, Japanese millet, Florida beggarweed, and shallu sorghum.

(b) Central Alabama: Common lespedeza, Korean lespedeza, Florida beggarweed, sesbania (on low lands), browntop millet, German millet, Texas millet, Laredo soybean, mung bean, amber sorghum, brabham cowpea, benc, sagrain sorghum, and Japanese millet.

(c) Coastal region: Common lespedeza, Florida beggarweed, sesbania, browntop millet, German millet, Texas millet, mung bean, Brabham cowpea, Laredo soybean, benc, Japanese millet, proso millet, amber sorghum, and sagrain sorghum.

3. Lespedeza sericea and native vetch are considered valuable plants to be grown for quail in Alabama but insufficient information was obtained to classify them according to importance. They are recommended for use in all sections of the State.

4. Nine plants were found undesirable, namely: Kafir corn, hegari sorghum, redtop sorghum, Sudan grass, pearl millet, iron cowpea, partridge pea, pigeon pea, and Strophostyles helvola.

The helminth parasites of cottontails in the vicinity of Auburn, Alabama, by Eugenia Rutland Moore. August 1939.

1. A survey was conducted to determine the species and relative prevalence of internal parasites of cottontail rabbits in the vicinity of Auburn, Alabama, and to study their effect on rabbits and other hosts, especially on man and on domestic animals.

2. The survey was made during the spring and summer of 1939, 50 cottontail rabbits (Sylvilagus floridanus mallurus) being collected and examined principally for helminth parasites. The viscera, mesenteries, brain, and skin were examined, the parasites collected and identified, and the degree of each infestation noted.

3. Parasites were found in all except 2 very young rabbits with an average of 4.5 species per host (including the arthropod, Linguatula serrata). Six species of nematodes, four of cestodes, and one of trematode were found. The percentages of rabbits in which various parasites were found are as follows: Obeliscoides cuniculi, 88 percent; Cittotaenia variabilis, 76 percent; Cysticercus pisiformis, 64 percent; Dermatoxys veligera, 60 percent; Longistriata sp. (probably noviberine), 40 percent; Trichostrongylus calcaratus, 40 percent; Raillietina salmoni, 32 percent; Haastilosia tricolor, 20 percent; Trichuris leporis, 10 percent; Passalurus ambiguus, 6 percent; and Multiceps serialis, 4 percent. The arthropod, Linguatula serrata, was more prevalent than many of the helminths, being found in 40 percent of the rabbits. These results corresponded more closely, both in species of parasites and in their prevalence, to those of other surveys made of rabbits in the southeastern part of the United States than to those of more distant studies.

4. Only a few of the parasites found in these investigations appear to be particularly pathogenic to rabbits. Multiceps serialis and Trichostrongylus calcaratus are probably the most pathogenic species found, the former because of the pressure exerted on the tissues and the latter because of its toxic properties. All species, however, except possibly Passalurus ambiguus, are known to be capable of producing serious effects in heavy infestations. The damage caused by helminths, as observed by various investigators, includes: Destruction of tissue by their hooks or suckers or by extra-intestinal digestion; loss of blood; opening of atria of infection for bacteria; hindrance of proper functioning of organs by pressure on them; toxic effects; and inducement of malignancy, especially in the liver and lungs.

5. Cysticercus pisiformis, Multiceps serialis, and the larva of Linguatula serrata, which were found in a high percentage of rabbits examined, are a constant threat to the health of domestic animals. The adults of all three of these parasites infest dogs and the larva of L. serrata is common in cattle, goats, and sheep. The adult cestodes apparently cause little injury to domestic animals, but the arthropod is quite pathogenic. Many may also be infested with M. serialis and very rarely with L. serrata.

AUTHOR INDEX FOR THIS ISSUE

	Page
Aldous, Clarence M.	15
Allan, Philip F.	23
Allen, Durward L.	28
Allen, Joseph C.	11
Baker, John H.	16
Baumgartner, F. M.	13
Baumgartner, Luther L.	11
Benjamin, J. R.	15
Bennett, Logan J.	4
Bennitt, Rudolf	14
Benson, Dirck	25
Bourn, Warren S.	5, 6
Bradt, G. W.	16
Bump, Gardiner	2, 27
Burlington, H. J.	15
Chapman, Floyd B.	12
Clark, Leonard	27
Clarke, J. Lyell	6
Clarke, T. E.	10, 11
Cliff, Edward P.	8
Cline, Justus H.	16
Coburn, Don R.	3
Cottam, Clarence	5, 6, 10
Darrow, Robert	10
Davenport, La Verne A.	10
Davis, C. N.	23
Day, Albert M.	19
Dill, Herbert H.	24
Dixon, Joseph S.	20
Edminster, Frank C.	22
Einarson, Arthur S.	20
Enders, Robert K.	14
Errington, Paul L.	28
Franklin, Sydney	22
Gabrielson, Ira N.	2
Gorstell, Richard	27
Girard, George L.	14
Gower, W. Carl	27
Graham, Edward H.	23
Gray, Donald V.	8
Griffith, Richard E.	3
Hendrickson, George O.	21
Henry, Cordia J.	24
Hermel, Louis C.	8
Hicks, Lawrence E.	26
Hochbaum, Albert	13
Hoffmaster, P. J.	19
Hull, A. V.	26
Ivoy, Julian C.	29
Jones, Elmer A.	32
Jones, Walter B.	6
Kalmbach, E. R.	7
Kirk, Walter F.	16
Leedy, Daniel L.	5, 26
Leopold, Aldo	16
Lloyd, Hoyes	2
MacNamara, Lester G.	16
Martin, A. C.	11
May, Franklin H.	11
McCain, Randal	22
Moore, Eugenia Rutland	34
Moore, George C.	13
Mullen, Frank E.	9
Nagel, Werner O.	25
Palmer, E. Laurence	9
Pearson, Allen M.	13
Quortrup, E. R.	3
Randall, Pierce E.	4
Rasmusson, D. I.	12
Ross, W. A.	9
Ruff, Frederick J.	4
Ruggles, Dyer H.	32
Saunders, Roy D.	20
Sharp, Ward M.	22
Smith, Robert H.	24
Shoemaker, Carl D.	19
Short, Alexander W.	19
Stebler, A. M.	28
Stoenis, John H.	25
Summer, E. Lowell, Jr.	20
Taylor, Walter P.	16
Titus, Harold	16
Towle, Robert E.	25
Uhler, F. M.	10
Wade, Douglas E.	29
Wallace, Tom	9
Warburton, C. W.	9
Webb, James W.	33
Whitlock, S. C.	4
Williams, Louis L.	6
Wood, George W.	16

AUTHOR INDEX TO TRANSACTIONS OF THE FOURTH NORTH AMERICAN WILDLIFE CONFERENCE

	Page
Adams, William C.	30
Aldous, Clarence M.	437
Allan, Philip F.	339
Allen, Durward L.	628
Allen, Joseph C.	253
Baker, Clarence M.	56
Baker, John H.	152
Baumgartner, F. M.	485
Baumgartner, Luther L.	579
Benjamin, J. R.	635
Bennett, George W.	311
Bennett, Logan J.	431
Bennitt, Rudolf	491
Benson, Dirck	411
Bourn, Warren S.	121, 343
Bradt, G. W.	179
Bump, Gardiner	442, 478
Burlington, H. J.	546
Cahn, A. R.	296
Carbine, W. F.	275
Chapman, Floyd B.	257
Clark, Leonard	442
Clarke, J. Lyell	130
Clarke, T. E.	570, 605
Cliff, Edward P.	560
Cline, Justus H.	185
Coburn, Don R.	359
Cottam, Clarence	121, 343 605
Darrow, Robert	585
Davenport, La Verne A.	268
Davis, C. N.	519
Day, Albert M.	12
Dill, Herbert H.	474
Dixon, Joseph S.	231
Eddy, Samuel	505
Edminster, Frank C.	534
Einarsen, Arthur S.	216
Enders, Robert K.	631
Errington, Paul L.	422
Finley, William L.	34
Franklin, Sydney	508
Gabrielson, Ira N.	78
Gerstell, Richard	462
Girard, George L.	364
Gower, W. Carl	426
Graham, Edward H.	501
Gray, Donald V.	554
Griffith, Richard E.	406
Hendrickson, Geo. O.	209
Henry, Cordia J.	372
Hormel, Louis C.	554
Hicks, Lawrence E.	449
Hochbaum, Albert	389
Hoffmaster, P. J.	19
Hull, A. V.	379
Jones, Walter B.	118
Kalmbach, E. R.	591
Kirk, Walter F.	189
Klassen, C. W.	62
Leedy, Daniel L.	449, 525
Leitch, R. D.	50
Leonard, Justin W.	288
Leopold, Aldo	145
Lloyd, Hoyes	75
MacNamara, Lester G.	162
Martin, A. C.	570
May, Franklin H.	570
McCain, Randal	221
Moore, George C.	468
Mullen, Frank E.	109
Nagel, Werner O.	416
Needham, Paul R.	300, 326
Palmer, E. Laurence	98
Pearson, Allen M.	468
Quortrup, E. R.	359
Randall, Pierce E.	431
Rasmusson, D. I.	235
Reid, Kenneth	44
Ross, W. A.	87
Ruff, Frederick J.	542
Sanders, Roy D.	549
Sharp, Ward M.	351
Shetter, David S.	318
Smith, E. V.	332
Smith, Robert H.	395
Shoemaker, Carl D.	17
Short, Alexander W.	514
Stobler, A. M.	203
Stoenis, John H.	400
Stegeman, LeRoy C.	623
Stoudt, Jerome H.	305
Sumner, E. Lowell, Jr.	231
Swingle, H. S.	332
Taylor, Walter P.	155
Thompson, David H.	311
Titus, Harold	176
Towle, Robert E.	383
Uhler, F. M.	605
Van Oosten, John	25
Wade, Douglas E.	250
Wallace, Tom	104
Warburton, C. W.	93
Westerman, Fred A.	36
Whitlock, S. C.	244
Williams, Louis L.	114
Wood, George W.	149

[Detach and insert in your volume]